C1 Surds Answers

Specimen

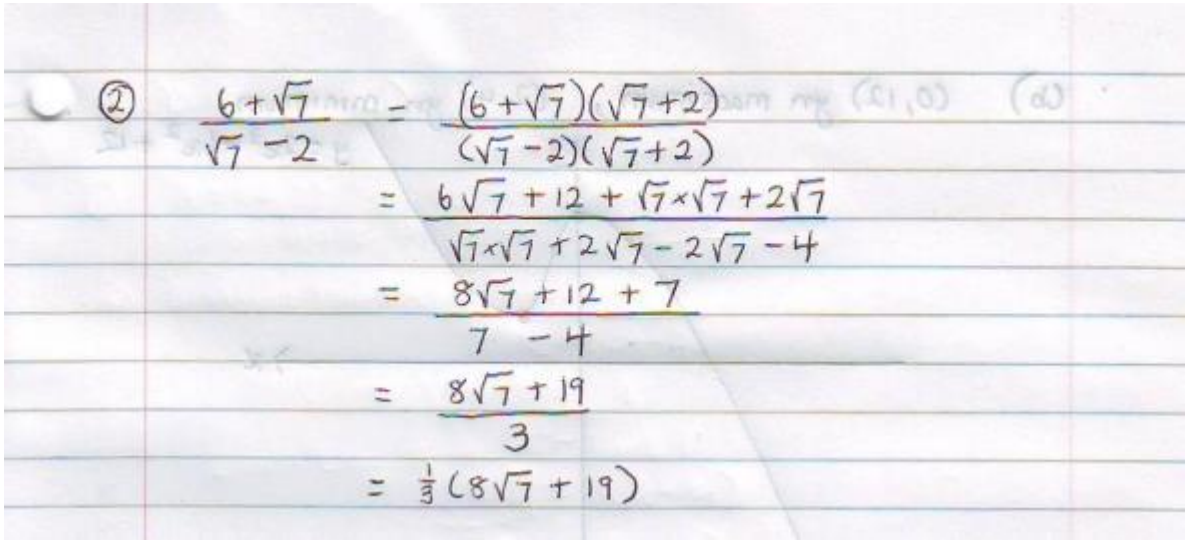
2. $\dfrac{(2\sqrt{5}+\sqrt{2})(\sqrt{5}+\sqrt{2})}{(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})} = \dfrac{10+2\sqrt{10}+\sqrt{10}+2}{5-2}$ M1 (rationalise)

A1 (numerator unsimplified)
A1 (denominator unsimplified)

$= \dfrac{12+3\sqrt{10}}{3}$

$= 4+\sqrt{10}$ A1

2005 Winter



② $\dfrac{6+\sqrt{7}}{\sqrt{7}-2} = \dfrac{(6+\sqrt{7})(\sqrt{7}+2)}{(\sqrt{7}-2)(\sqrt{7}+2)}$

$= \dfrac{6\sqrt{7}+12+\sqrt{7}\times\sqrt{7}+2\sqrt{7}}{\sqrt{7}\times\sqrt{7}+2\sqrt{7}-2\sqrt{7}-4}$

$= \dfrac{8\sqrt{7}+12+7}{7-4}$

$= \dfrac{8\sqrt{7}+19}{3}$

$= \frac{1}{3}(8\sqrt{7}+19)$

2005 Summer

2. (a) $3\sqrt{5}+4\sqrt{5}-5\sqrt{5}=2\sqrt{5}$

M1(attempt to simplify/one correct answer)
A1 (all correct)
A1 (F.T. one slip with answer of form $k\sqrt{5}$)

(b) $\dfrac{(6+\sqrt{2})(2-\sqrt{2})}{(2+\sqrt{2})(2-\sqrt{2})}=\dfrac{12-6\sqrt{2}+2\sqrt{2}-2}{4-2}$

M1 (correct rationalising)

A1 (numerator with $(\sqrt{2})^2=2$, allow 2×6)

A1 (denominator with no ??)

$=5-2\sqrt{2}$ (allow $\dfrac{10-4\sqrt{2}}{2}$)

A1 (F.T. one slip)

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2006 Winter

2. *(a)* $4\sqrt{3}+3\sqrt{3}-2\sqrt{3}$

B1, B1, B1

$=5\sqrt{3}$

B1 (F.T. one slip, answer of form $k\sqrt{3}$)

(b) $\dfrac{(2+\sqrt{7})(3-\sqrt{7})}{(3+\sqrt{7})(3-\sqrt{7})}=\dfrac{6-2\sqrt{7}+\sqrt{7}-7}{9-7}$

M1 (correct rationalising)

A1 numerator with $(\sqrt{7})^2=7$, allow 2×3
A1 (denominator with no surds)

$=\dfrac{\sqrt{7}-1}{2}$

A1 (F.T. one slip)

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2006 Summer

2. (*a*) $\dfrac{5-\sqrt{3}}{\sqrt{3}+1}=\dfrac{(5-\sqrt{3})(\sqrt{3}-1)}{(\sqrt{3}+1)(\sqrt{3}-1)}$ M1

Numerator: $5\sqrt{3}-5-3+\sqrt{3}$ A1

Denominator: $3-1$ A1

$\dfrac{5-\sqrt{3}}{\sqrt{3}+1}=3\sqrt{3}-4$ A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $a+\sqrt{3}b$

(*b*) Removing brackets M1

$\sqrt{12}=2\times\sqrt{3}$ B1

$\sqrt{12}\times\sqrt{3}=6$ B1

$(2+\sqrt{3})(4-\sqrt{12})=2$ (c.a.o.) A1

2007 Winter

2. (*a*) $2\sqrt{32}+3\sqrt{8}-\sqrt{18}=8\sqrt{2}+6\sqrt{2}-3\sqrt{2}$ (one correct) B1

(another correct) B1

$2\sqrt{32}+3\sqrt{8}-\sqrt{18}=11\sqrt{2}$ (c.a.o.) B1

(*b*) $\dfrac{6+\sqrt{30}}{6-\sqrt{30}}=\dfrac{(6+\sqrt{30})(6+\sqrt{30})}{(6-\sqrt{30})(6+\sqrt{30})}$ M1

Numerator: $36+30+6\sqrt{30}+6\sqrt{30}$ A1

Denominator: $36-30$ A1

$\dfrac{6+\sqrt{30}}{6-\sqrt{30}}=11+2\sqrt{30}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $6-\sqrt{30}$

2007 Summer

2. (*a*) $2\sqrt{8} = 2 \times 2 \times \sqrt{2}$ B1

$\sqrt{18} = 3\sqrt{2}$ B1

$\frac{12}{\sqrt{2}} = 3 \times 2 \times \sqrt{2}$ B1

$2\sqrt{8} + \sqrt{18} - \frac{12}{\sqrt{2}} = \sqrt{2}$ (c.a.o.) B1

(*b*) $\frac{5+\sqrt{15}}{5-\sqrt{15}} = \frac{(5+\sqrt{15})(5+\sqrt{15})}{(5-\sqrt{15})(5+\sqrt{15})}$ M1

Numerator: $25 + 15 + 5\sqrt{15} + 5\sqrt{15}$ A1

Denominator: $25 - 15$ A1

$\frac{5+\sqrt{15}}{5-\sqrt{15}} = 4 + \sqrt{15}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $5 - \sqrt{15}$

2008 Winter

2. (*a*) $\sqrt{20} = 2\sqrt{5}$ B1

$\frac{\sqrt{35}}{\sqrt{7}} = \sqrt{5}$ B1

$\frac{20}{\sqrt{5}} = 4\sqrt{5}$ B1

$\sqrt{20} + \frac{\sqrt{35}}{\sqrt{7}} - \frac{20}{\sqrt{5}} = -\sqrt{5}$ (c.a.o.) B1

(*b*) $\frac{2+\sqrt{3}}{5+2\sqrt{3}} = \frac{(2+\sqrt{3})(5-2\sqrt{3})}{(5+2\sqrt{3})(5-2\sqrt{3})}$ M1

Numerator: $10 - 4\sqrt{3} + 5\sqrt{3} - 2 \times 3$ A1

Denominator: $25 - 12$ A1

$\frac{2+\sqrt{3}}{5+2\sqrt{3}} = \frac{4+\sqrt{3}}{13}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $5 + 2\sqrt{3}$

2008 Summer

2. (*a*) **Either:**

$\sqrt{75} = 5\sqrt{3}$ B1

$\frac{9}{\sqrt{3}} = 3\sqrt{3}$ B1

$\sqrt{6} \times \sqrt{2} = 2\sqrt{3}$ B1

$\sqrt{75} - \frac{9}{\sqrt{3}} + (\sqrt{6} \times \sqrt{2}) = 4\sqrt{3}$ (c.a.o.) B1

Or:

$\sqrt{75} = \frac{15}{\sqrt{3}}$ B1

$\sqrt{6} \times \sqrt{2} = \frac{6}{\sqrt{3}}$ B1

$\sqrt{75} - \frac{9}{\sqrt{3}} + (\sqrt{6} \times \sqrt{2}) = \frac{12}{\sqrt{3}}$ B1

$\sqrt{75} - \frac{9}{\sqrt{3}} + (\sqrt{6} \times \sqrt{2}) = 4\sqrt{3}$ (c.a.o.) B1

(*b*) $\frac{5\sqrt{5} - 2}{4 + \sqrt{5}} = \frac{(5\sqrt{5} - 2)(4 - \sqrt{5})}{(4 + \sqrt{5})(4 - \sqrt{5})}$ M1

Numerator: $20\sqrt{5} - 25 - 8 + 2\sqrt{5}$ A1

Denominator: $16 - 5$ A1

$\frac{5\sqrt{5} - 2}{4 + \sqrt{5}} = 2\sqrt{5} - 3$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $4 + \sqrt{5}$

2009 Winter

2. (*a*) $\dfrac{10\sqrt{3}-1}{4-\sqrt{3}} = \dfrac{(10\sqrt{3}-1)(4+\sqrt{3})}{(4-\sqrt{3})(4+\sqrt{3})}$ M1

Numerator: $40\sqrt{3} + 10 \times 3 - 4 - \sqrt{3}$ A1

Denominator: $16 - 3$ A1

$\dfrac{10\sqrt{3}-1}{4-\sqrt{3}} = \dfrac{39\sqrt{3}+26}{13} = 3\sqrt{3}+2$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $4 - \sqrt{3}$

(*b*) $(2+\sqrt{5})(5-\sqrt{20}) = 10 - 2\sqrt{20} + 5\sqrt{5} - \sqrt{5} \times \sqrt{20}$

(4 terms, at least 3 correct) M1

$\sqrt{20} = 2\sqrt{5}$ B1

$\sqrt{5} \times \sqrt{20} = 10$ B1

$(2+\sqrt{5})(5-\sqrt{20}) = \sqrt{5}$ (c.a.o.) A1

Alternative Mark Scheme

$(2+\sqrt{5})(5-\sqrt{20}) = (2+\sqrt{5})(5-2\sqrt{5})$ B1

$(2+\sqrt{5})(5-2\sqrt{5}) = 10 - 4\sqrt{5} + 5\sqrt{5} - \sqrt{5} \times 2\sqrt{5}$

(4 terms, at least 3 correct) M1

$\sqrt{5} \times 2\sqrt{5} = 10$ B1

$(2+\sqrt{5})(5-\sqrt{20}) = \sqrt{5}$ (c.a.o.) A1

2009 Summer

2. (*a*) $\dfrac{8-\sqrt{7}}{\sqrt{7}-2}=\dfrac{(8-\sqrt{7})(\sqrt{7}+2)}{(\sqrt{7}-2)(\sqrt{7}+2)}$ M1

Numerator: $8\sqrt{7}+16-7-2\sqrt{7}$ A1

Denominator: $7-4$ A1

$\dfrac{8-\sqrt{7}}{\sqrt{7}-2}=\dfrac{6\sqrt{7}+9}{3}=2\sqrt{7}+3$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $\sqrt{7}-2$

(*b*) $\sqrt{50}=5\sqrt{2}$ B1

$\sqrt{3}\times\sqrt{6}=3\sqrt{2}$ B1

$-\dfrac{14}{\sqrt{2}}=-7\sqrt{2}$ B1

$\sqrt{50}+(\sqrt{3}\times\sqrt{6})-\dfrac{14}{\sqrt{2}}=\sqrt{2}$ (c.a.o.) B1

2010 Winter

2. (*a*) $\dfrac{2\sqrt{11}-3}{\sqrt{11}+2}=\dfrac{(2\sqrt{11}-3)(\sqrt{11}-2)}{(\sqrt{11}+2)(\sqrt{11}-2)}$ M1

Numerator: $22-4\sqrt{11}-3\sqrt{11}+6$ A1

Denominator: $11-4$ A1

$\dfrac{2\sqrt{11}-3}{\sqrt{11}+2}=4-\sqrt{11}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $\sqrt{11}+2$

(*b*) $\dfrac{22}{\sqrt{2}}=11\sqrt{2}$ B1

$\sqrt{50}=5\sqrt{2}$ B1

$(\sqrt{2})^5=4\sqrt{2}$ B1

$\dfrac{22}{\sqrt{2}}-\sqrt{50}-(\sqrt{2})^5=2\sqrt{2}$ (c.a.o.) B1

2010 Summer

2. (*a*) $\dfrac{5\sqrt{7}-\sqrt{3}}{\sqrt{7}-\sqrt{3}} = \dfrac{(5\sqrt{7}-\sqrt{3})(\sqrt{7}+\sqrt{3})}{(\sqrt{7}-\sqrt{3})(\sqrt{7}+\sqrt{3})}$ M1

Numerator: $5 \times 7 + 5 \times \sqrt{7} \times \sqrt{3} - \sqrt{7} \times \sqrt{3} - 3$ A1

Denominator: $7 - 3$ A1

$\dfrac{5\sqrt{7}-\sqrt{3}}{\sqrt{7}-\sqrt{3}} = 8 + \sqrt{21}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $\sqrt{7} - \sqrt{3}$

(*b*) $\sqrt{15} \times \sqrt{20} = 10\sqrt{3}$ B1

$\sqrt{75} = 5\sqrt{3}$ B1

$\dfrac{\sqrt{60}}{\sqrt{5}} = 2\sqrt{3}$ B1

$(\sqrt{15} \times \sqrt{20}) - \sqrt{75} - \dfrac{\sqrt{60}}{\sqrt{5}} = 3\sqrt{3}$ (c.a.o.) B1

2011 Winter

2. $\dfrac{\sqrt{2}}{10-7\sqrt{2}} = \dfrac{\sqrt{2} \times (10+7\sqrt{2})}{(10-7\sqrt{2})(10+7\sqrt{2})}$ M1

Numerator: $10\sqrt{2} + 14$ A1

Denominator: $100 - 98$ A1

$\dfrac{\sqrt{2}}{10-7\sqrt{2}} = 5\sqrt{2} + 7$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $10 - 7\sqrt{2}$

2011 Summer

2. (*a*) **Either:**

$\dfrac{9(\sqrt{3}+1)+7(\sqrt{3}-1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$ M1

Numerator: $9\sqrt{3}+9+7\sqrt{3}-7$ A1

Denominator: $3-1$ A1

$\dfrac{9}{\sqrt{3}-1}+\dfrac{7}{\sqrt{3}+1}=8\sqrt{3}+1$ (c.a.o.) A1

Or:

$\dfrac{9}{\sqrt{3}-1}=\dfrac{9(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$, $\dfrac{7}{\sqrt{3}+1}=\dfrac{7(\sqrt{3}-1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$ (at least one) M1

Numerators: $9\sqrt{3}+9$, $7\sqrt{3}-7$ (both correct) A1

Denominators: $3-1$ (both correct) A1

$\dfrac{9}{\sqrt{3}-1}+\dfrac{7}{\sqrt{3}+1}=8\sqrt{3}+1$ (c.a.o.) A1

(*b*) $\dfrac{90}{\sqrt{3}}=30\sqrt{3}$ B1

$\sqrt{6}\times\sqrt{8}=4\sqrt{3}$ B1

$(2\sqrt{3})^3=24\sqrt{3}$ B1

$\dfrac{90}{\sqrt{3}}-\sqrt{6}\times\sqrt{8}-(2\sqrt{3})^3=2\sqrt{3}$ (c.a.o.) B1

2012 Winter

2. (*a*) $\frac{9+4\sqrt{2}}{5+3\sqrt{2}} = \frac{(9+4\sqrt{2})(5-3\sqrt{2})}{(5+3\sqrt{2})(5-3\sqrt{2})}$ M1

Numerator: $45 - 27\sqrt{2} + 20\sqrt{2} - 24$ A1

Denominator: $25 - 18$ A1

$\frac{9+4\sqrt{2}}{5+3\sqrt{2}} = 3 - \sqrt{2}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $5 + 3\sqrt{2}$

(*b*) $\sqrt{8} \times \sqrt{10} = 4\sqrt{5}$ B1

$\frac{\sqrt{90}}{\sqrt{2}} = 3\sqrt{5}$ B1

$\frac{30}{\sqrt{5}} = 6\sqrt{5}$ B1

$(\sqrt{8} \times \sqrt{10}) + \frac{\sqrt{90}}{\sqrt{2}} - \frac{30}{\sqrt{5}} = \sqrt{5}$ (c.a.o.) B1

2012 Summer

2. (*a*) $\frac{10}{7+2\sqrt{11}} = \frac{10(7-2\sqrt{11})}{(7+2\sqrt{11})(7-2\sqrt{11})}$ M1

Denominator: $49 - 44$ A1

$\frac{10}{7+2\sqrt{11}} = \frac{10(7-2\sqrt{11})}{5} = 2(7-2\sqrt{11}) = 14 - 4\sqrt{11}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified denominator following multiplication of top and bottom by $7 + 2\sqrt{11}$

(*b*) $(4\sqrt{3})^2 = 48$ B1

$\sqrt{8} \times \sqrt{50} = 20$ B1

$\frac{5\sqrt{63}}{\sqrt{7}} = 15$ B1

$(4\sqrt{3})^2 - (\sqrt{8} \times \sqrt{50}) - \frac{5\sqrt{63}}{\sqrt{7}} = 13$ (c.a.o.) B1

2013 Winter

2. (*a*) $\dfrac{6\sqrt{7}-11\sqrt{2}}{\sqrt{7}-\sqrt{2}} = \dfrac{(6\sqrt{7}-11\sqrt{2})(\sqrt{7}+\sqrt{2})}{(\sqrt{7}-\sqrt{2})(\sqrt{7}+\sqrt{2})}$ M1

Numerator: $6\times 7 + 6\times\sqrt{7}\times\sqrt{2} - 11\times\sqrt{7}\times\sqrt{2} - 11\times 2$ A1

Denominator: $7-2$ A1

$\dfrac{6\sqrt{7}-11\sqrt{2}}{\sqrt{7}-\sqrt{2}} = 4-\sqrt{14}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $\sqrt{7}-\sqrt{2}$

(*b*) $\dfrac{3}{2\sqrt{6}} = p\sqrt{6}$, where p is a fraction equivalent to $^1/_4$ B1

$\left[\dfrac{\sqrt{6}}{2}\right]^3 = q\sqrt{6}$, where q is a fraction equivalent to $^3/_4$ B1

$\dfrac{3}{2\sqrt{6}} + \left[\dfrac{\sqrt{6}}{2}\right]^3 = \sqrt{6}$ (c.a.o.) B1

2013 Summer

2. (*a*) $\dfrac{2+5\sqrt{7}}{4+\sqrt{7}} = \dfrac{(2+5\sqrt{7})(4-\sqrt{7})}{(4+\sqrt{7})(4-\sqrt{7})}$ M1

Numerator: $8-2\sqrt{7}+20\sqrt{7}-35$ A1

Denominator: $16-7$ A1

$\dfrac{2+5\sqrt{7}}{4+\sqrt{7}} = -3+2\sqrt{7}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $4+\sqrt{7}$

(*b*) $\sqrt{360} = 6\sqrt{10}$ B1

$\sqrt{2}\times(\sqrt{5})^3 = 5\sqrt{10}$ B1

$\dfrac{\sqrt{30}\times\sqrt{8}}{\sqrt{6}} = 2\sqrt{10}$ B1

$\sqrt{360} - \sqrt{2}\times(\sqrt{5})^3 - \dfrac{\sqrt{30}\times\sqrt{8}}{\sqrt{6}} = -\sqrt{10}$ (c.a.o.) B1

2014 Winter

2. $\frac{3\sqrt{3}-2\sqrt{5}}{2\sqrt{3}+\sqrt{5}} = \frac{(3\sqrt{3}-2\sqrt{5})(2\sqrt{3}-\sqrt{5})}{(2\sqrt{3}+\sqrt{5})(2\sqrt{3}-\sqrt{5})}$ M1

Numerator: $6 \times 3 - 3 \times \sqrt{3} \times \sqrt{5} - 4 \times \sqrt{5} \times \sqrt{3} + 10$ A1

Denominator: $12 - 5$ A1

$\frac{3\sqrt{3}-2\sqrt{5}}{2\sqrt{3}+\sqrt{5}} = 4 - \sqrt{15}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $2\sqrt{3} + \sqrt{5}$

2. (*a*) $\frac{3\sqrt{3}+1}{5\sqrt{3}-7} = \frac{(3\sqrt{3}+1)(5\sqrt{3}+7)}{(5\sqrt{3}-7)(5\sqrt{3}+7)}$ M1

Numerator: $45 + 21\sqrt{3} + 5\sqrt{3} + 7$ A1

Denominator: $75 - 49$ A1

$\frac{3\sqrt{3}+1}{5\sqrt{3}-7} = 2 + \sqrt{3}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $5\sqrt{3} - 7$

(*b*) $\sqrt{12} \times \sqrt{24} = 12\sqrt{2}$ B1

$\frac{\sqrt{150}}{\sqrt{3}} = 5\sqrt{2}$ B1

$\frac{36}{\sqrt{2}} = 18\sqrt{2}$ B1

$(\sqrt{12} \times \sqrt{24}) + \frac{\sqrt{150}}{\sqrt{3}} - \frac{36}{\sqrt{2}} = -\sqrt{2}$ (c.a.o.) B1

2015

2. (*a*) $\frac{4\sqrt{2}-\sqrt{11}}{3\sqrt{2}+\sqrt{11}} = \frac{(4\sqrt{2}-\sqrt{11})(3\sqrt{2}-\sqrt{11})}{(3\sqrt{2}+\sqrt{11})(3\sqrt{2}-\sqrt{11})}$ M1

Numerator: $12 \times 2 - 4 \times \sqrt{2} \times \sqrt{11} - 3 \times \sqrt{11} \times \sqrt{2} + 11$ A1

Denominator: $18 - 11$ A1

$\frac{4\sqrt{2}-\sqrt{11}}{3\sqrt{2}+\sqrt{11}} = 5 - \sqrt{22}$ (c.a.o.) A1

Special case

If M1 not gained, allow SC1 for correctly simplified numerator or denominator following multiplication of top and bottom by $3\sqrt{2} + \sqrt{11}$

(*b*) $\frac{7}{2\sqrt{14}} = p\sqrt{14}$, where p is a fraction equivalent to $^1/_4$ B1

$\left[\frac{\sqrt{14}}{2}\right]^3 = q\sqrt{14}$, where q is a fraction equivalent to $^7/_4$ B1

$\frac{7}{2\sqrt{14}} + \left[\frac{\sqrt{14}}{2}\right]^3 = 2\sqrt{14}$ (c.a.o.) B1

2016

2. $\dfrac{5\sqrt{7}+4\sqrt{2}}{3\sqrt{7}+5\sqrt{2}} = \dfrac{(5\sqrt{7}+4\sqrt{2})(3\sqrt{7}-5\sqrt{2})}{(3\sqrt{7}+5\sqrt{2})(3\sqrt{7}-5\sqrt{2})}$ M1

Numerator: $15 \times 7 - 25 \times \sqrt{7} \times \sqrt{2} + 12 \times \sqrt{2} \times \sqrt{7} - 20 \times 2$ A1

Denominator: $63 - 50$ A1

$\dfrac{5\sqrt{7}+4\sqrt{2}}{3\sqrt{7}+5\sqrt{2}} = 5 - \sqrt{14}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $3\sqrt{7} + 5\sqrt{2}$

2017

2. (*a*) $\dfrac{5\sqrt{5}-9}{3+2\sqrt{5}} = \dfrac{(5\sqrt{5}-9)(3-2\sqrt{5})}{(3+2\sqrt{5})(3-2\sqrt{5})}$ M1

Numerator: $15 \times \sqrt{5} - 10 \times 5 - 9 \times 3 + 18 \times \sqrt{5}$ A1

Denominator: $9 - 20$ A1

$\dfrac{5\sqrt{5}-9}{3+2\sqrt{5}} = 7 - 3\sqrt{5}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $3 + 2\sqrt{5}$

(*b*) $(2\sqrt{13})^2 = 52$ B1

$3\sqrt{7} \times \sqrt{28} = 42$ B1

$\dfrac{5\sqrt{99}}{\sqrt{11}} = 15$ B1

$(2\sqrt{13})^2 - 3\sqrt{7} \times \sqrt{28} - \dfrac{5\sqrt{99}}{11} = -5$ (c.a.o.) B1